MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018 / 2019

PEM0046 – INTRODUCTION TO PROBABILITY AND STATISTICS

(Foundation in Engineering)

7 MARCH 2019
2:30 p.m. – 4:30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **FIVE** printed pages including the cover page.
2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided. All necessary working steps **MUST** be shown.
4. Statistical table is provided.

Answer ALL questions [100 marks].

QUESTION 1 [25 marks]

a. There are six red balls and four blue balls in a bag. Along the way, five balls are lifted at random without replacement.

i. Construct the probability distribution for the number of red balls will be selected. Present your answer in tabular form. [6 marks]

ii. Find the probability that at most three red balls are selected. [1 mark]

iii. Find the expected value and the standard deviation for the number of red balls selected. [4 marks]

b. The length of a telephone call made to the receptionist counter is denoted by a continuous random variable Y. it is modelled by a probability density function of

$$f(y) = \begin{cases} k(y+1), & 0 \le y < 2 \\ 2k, & 2 \le y \le 3 \\ 0, & elsewhere \end{cases}$$

i. Prove that the value of constant $k = \frac{1}{6}$. [4 marks]

ii. Find $P(1.5 \le Y \le 2.5)$. [4 marks]

iii. Find the cumulative distribution function, $F(Y)$. [6 marks]

Continued...

QUESTION 2 [25 marks]

a. A geologist splitting and breaking rocks to look for fossils. It is known that 10% of the rock selected from a particular area contains fossils. If the geologist selects a random sample of 20 rocks from this area, find the probability that

i. exactly one of the rocks contains fossils. [2 marks]

ii. at least one of the rocks contains fossils. [2 marks]

iii. from 13 to 16 of the rocks **do not** contains fossils. [3 marks]

iv. Find the mean and standard deviation for the number of rocks contains fossils. [2 marks]

v. A random sample of n rocks is selected from this area. The geologist wants to have probability of 0.9 or greater of finding fossils in at least one of the n rocks. Find the least possible value of n. [5 marks]

b. Alfred Corporation has observed that batteries fail and need to be replaced at rate of 3 in 4 months.

i. What is the probability that no battery fail in 2 months? [1 mark]

ii. What is the probability that at least 5 batteries will fail in one year and at most 11 batteries will fail in the other year? [2 marks]

c. The scores on an exam in a certain secondary school follow a normal distribution with a mean of 60 and a standard deviation of 10.

i. Find the probability that a randomly selected student scored between 50 and 65. [3 marks]

ii. What is the probability that a randomly selected student scored more than the population mean by at least 15 marks? [2 marks]

iii. A scholarship is offered based on students' scores. It is known that, only the top 2% of students taking this exam will get scholarship. Find the lowest scores they need to receive the scholarship. [3 marks]

Continued...

QUESTION 3 [25 marks]

a. The data below shows the height (in meters) a ball bounced after being dropped from different heights.

11 7 9 12 14 10

Consider all possible samples of **size five** which can be drawn without replacement from this population.

i. Find the mean, μ and standard deviation, σ of the population. [3 marks]

ii. List all the possible samples of size five (without replacement) from this population, and hence determine the sample mean. [5 marks]

iii. Calculate the sampling error for each sample. [2 marks]

iv. Construct a sampling distribution of the sample mean in a table. [3 marks]

b. According to an automobile battery manufacturer, the lifetime of its midgrade battery is normally distributed with a mean of 50 months and a standard deviation of 6 months. Consider a random **sample of 36** such batteries, find

i. $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$. [2 marks]

ii. the probability that the sample mean will be less than 48 months. [2 marks]

iii. the probability that the sample mean will be below 47 months or above 52.5 months? [5 marks]

iv. the probability that the sample mean will be less than the population mean by at least 0.5 month or more. [3 marks]

Continued...

QUESTION 4 [25 marks]

The managers of a broker firm are interested in finding out if the number of new clients a broker brings into the firm is related to the sales generated by broker. They sample 10 brokers and determine the number of new clients they have enrolled in the last year and their sales amounts in thousands of dollars.

Broker	1	2	3	4	5	6	7	8	9	10
Number of New Client (x)	27	11	33	15	15	25	28	30	17	22
Sales Generated (y) (thousands dollars)	52	37	55	29	34	58	44	48	31	38

a. Draw a scatter diagram of y against x, on the graph paper provided. [2 marks]

b. Find the equation of the regression line. Hence, graph the line on the scatter diagram. [16 marks]

c. Predict the amount of sales (in thousands dollars) for a broker who brings 30 new clients into the firm. [2 marks]

d. Find the correlation coefficient between x and y and concludes your finding. [5 marks]

(Note: For Question 4, leave all your answers in 3 decimal points)

End of Page